It's not what, but where: How the accentuated features of the adventure sports coaching environment promote the development of sophisticated epistemic beliefs.

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This paper forwards the position that the adventure sports coaching environment contains features that are accentuated in comparison with traditional sports coaching contexts, and that these accentuated features are conducive to the development of sophisticated epistemic beliefs. We consider ~~how the combination of~~ the manner in which physical, social and temporal factors combine to create a complex and dynamic ~~space~~ coaching environment. ~~w~~Within this environment ~~which~~ the Adventure Sports Coach (ASC) must contend with an array of difficult decisions with serious consequences. This environment compels the ASC to continually compare, contrast, prioritise and evaluate information. Such cognitive processes are conducive to a conceptualisation of knowledge synonymous with a sophisticated epistemology. We explore this position from three theoretical perspectives: personal epistemology, pedagogy and ecological psychology.

Keywords: Epistemology, Pedagogy, Ecological Psychology.

Introduction

The study of adventure sports coaching as a sub-discipline of sports coaching has been the subject of increasing research interest over the last decade. As well as an evolving body of peer reviewed journal articles (Christian, Berry & Kearney, 2017; Collins & Collins, 2012, 2013, 2015, 2016, 2017; Collin, Collins & Grecic, 2014; Gray, 2016; Lorimer & Holland-Smith, 2012), there is at least one text book dedicated to the subject (Berry, Lomax & Hodgson, 2015). Examples of themes within the literature include: the identity and developmental experiences of adventure sport coaches (ASCs), coach-participant interactions, professional judgement and decision making, coaching in highly dynamic environments, and pedagogic and leadership strategies. One further theme, which is central to this paper and underpins much of the other research, relates to the philosophy of ASCs and particularly their epistemic beliefs. Collins et al. (2014) and Christian et al. (2017) found that highly experienced ASCs showed high levels of self-awareness in their coaching and evidenced a robust coupling between underpinning beliefs, philosophy, and coaching behaviours (termed the epistemological chain). Although this robust coupling is not remarkable in isolation, it presents a contrast to the findings from research on traditional sports coaches who generally, although not exclusively (Grecic & Collins, 2012), appear to be less epistemologically congruent (Ford, Yates & Williams, 2010; Millar Oldham & Donovan, 2011; Partington & Cushion, 2013). When the ASC

research is considered as a whole, it does appear that something 'a little bit different' is happening. We propose that this difference may be less to do with the 'what' of coaching and more about the 'where'.

Aims

This positional paper will follow the process adopted by Harwood and Knight (2015). Firstly, we will identify what we mean by the term 'adventure environment' and discuss how this is similar, and different to, the 'traditional sport' coaching environment. Secondly, we will present our position that the adventure environment contains features that are accentuated relative to the traditional sport context. We propose that these accentuated features of the temporally-dynamic social and physical environment have enhanced potential to shape a coach's epistemology, and are conducive to the development of a sophisticated epistemological chain. Finally, we will explore this position from three theoretical perspectives that explain the impact of these accentuated features: personal epistemology, pedagogy and ecological psychology. We will also apply our own professional experiences as ASCs. We wish to be absolutely clear in that we do not consider any type of coach to be better or worse, or any type of coaching to be more or less complex. Rather, we assert there are simply nuances between the two domains of coaching that are mediated by the environment in which they take place. We hope that this paper will stimulate debate within practicing ASCs and academics, and encourage practitioners to evaluate this and other associated literature with their own context in mind.

The Adventure Environment

All environments are multifaceted, containing both a physical structure and a social dynamic, which are embedded within a temporal flow. For adventure sports, these factors interact to create a highly complex and continually fluctuating environment. Whilst we accept that all coaching takes place in a dynamic and changeable environment, we believe that there are some important distinctions to be made between the adventure and traditional sports contexts.

The physical structure of the adventure environment differs from that of the traditional environment in two key ways: in the amount of variability in physical structures likely to be encountered, and in the degree of control that a coach possesses over this variation. For example, every football pitch shares a common flat grass surface, augmented by globally consistent, rule-based features such as pitch markings, goal posts and corner flags. A coach may impose additional arbitrary rules to further shape the environment (e.g., further reduction in playing area, alteration of number of players, etc.). By contrast, an adventure environment is much less uniform. A kayaker on a river trip, or a climber

on a mountain ascent, will encounter a great diversity of physical structures on their journey (changes will depend on gradient, geology, obstructions, and channel shape). Furthermore, the adventure sport coach has much less capacity to shape his/her physical environment, instead selecting from and adapting to the physical conditions that emerge. This variability leads to an increase in the number of options, corresponding awareness and decision making requirements.

The socio-cultural environment for traditional sports is characterised by both competitive and cooperative social dynamics, whilst adventure sports are normally devoid of overt human competition (Berry, Lomax & Hodgson, 2015). Typically, the aim of a traditional sport is to out-perform human opponents whereas adventure sports are normally characterised by negotiating environmental challenges, that said we do acknowledge that competitive comparisons are often made outside of the activity (Tejada-Flores, 1995). Traditional sports such as rugby or athletics are bound by officially sanctioned rules that dictate the way the participants and coaches behave. In the absence of such arbitrary rules ASCs' behaviours tend to differ in response to broader ethical guidelines and naturalistic challenges (Tejada-Flores, 1995). For example, in football coaching sessions the coach may kick the ball but never during the game. The ASC on the other hand, possessing both high-level coaching skills and personal performance abilities, can actually assist the performers throughout 'the game' such as performing rescues, belaying and demonstrating the line of safe passage (Collins & Collins, 2012). In fact, on occasion the coach's performance may rely on the skills of the learner; for example, a climbing coach may need the learner to belay them. We propose that the inherently cooperative nature of performing whilst coaching within an adventure environment and flexibility of outcomes combine to reduce dualistic coach-performer relationships. We consider this relationship to be more conducive to an exploratory and reflective coaching mind-set.

The physical and social environments can fluctuate through time. For example, the first five minutes of a football match are likely to be different to the last five due to a host of factors including fatigue, score line and emotions. Equally and perhaps additionally, the sea state during a sailing session will change during the day as a result of tidal influences and meteorological conditions. Furthermore, a specific demand of the ASC is to ensure the participants arrive at specific environmental challenges throughout the journey in as good physical and mental state as possible. Whilst this is also true of the coach in traditional sports contexts, the consequences for the ASC are more acute due to the higher level of involvement of the coach. For example, poor time management and decision making will lead to the ASC having to work physically and cognitively harder to remedy the situation. This may mean more direct coaching or performing more rescues and/or evacuation**.** We propose that the temporal flow of physical and social dynamics of coaching are accentuated for ASCs due to the

more severe consequences of poor decision making or of the inability to read the emotional state of learners. We consider this increased demand to contribute to the exploratory mind-set of the ASC, which is characterised by constant analysis of options, risk assessment and judgement (Collins & Collins, 2016).

The interplay of the three factors of physical structure, social dynamic, and temporal flow constantly present coaches (traditional and ASC) with a challenge to react and respond in an appropriate manner in order to elicit the best response from their learners. Specifically, we consider the key differences between the adventure and traditional sports coaching environment to be: a greater diversity of naturally occurring variations in physical structure outside of the coaches control that lead to inherent environmental challenges; a more cooperative coach-performer relationship due to performance being constrained by 'norms' rather than rules ~~the absence of 'rules'~~; and the need for the ASC to manage the physical and social aspects of the environment over time in order to negotiate challenges that have the potential for significant psychological and physical harm. In the following sections we will outline how the demands of coaching in the adventure environment facilitates the development of a sophisticated epistemological chain. Broadly speaking, we consider epistemological development to be a function of how negotiated coaching aims are conducive to 'uncertainty', how this uncertainty results in increased analysis, comparison, questioning and prioritisation; and how the cooperative nature of 'sharing' the activity results in a more exploratory mind-set.

Conceptions of knowledge – Personal Epistemology

The term "epistemological beliefs" refers to the views that an individual holds about the nature of knowledge, and of knowing. Schommer (1990) conceptualised epistemological beliefs as multi-faceted, comprising of a belief system of five relatively independent dimensions about knowledge and learning (see figure 1). Each of these dimensions is proposed to exist on a continuum. An individual holding wholly naïve epistemological beliefs would conceive of knowledge as simple, certain and passed down by omniscient authority. Furthermore, they would view the ability to learn as fixed and that learning will happen quickly or not at all. Conversely, a sophisticated epistemology would be characterised by an individual who views knowledge as highly integrated and interwoven, as constantly evolving and personally constructed through a process of reflection and logical reasoning. Also, within a sophisticated epistemology the ability to learn is viewed as malleable, gradual and a process of experience. Schommer (1994) subsequently elaborated on her original conceptions, adding that the complexity of epistemological beliefs could be viewed as 'frequency

distributions' rather than as a fixed point on the continua. For example, an individual operating a sophisticated epistemological position might view a large amount of knowledge as tentative, some knowledge as relatively well defined and a small amount of knowledge as certain.

INSERT FIGURE 1 HERE

Figure 1. Schommer's (1990) dimensions of personal epistemology

To elaborate further, we might consider an example using the first three of Schommer's dimensions (the structure, certainty and source of knowledge) and apply these to a fundamental skill in adventure sports coaching: the kayak roll. In this example a coach who holds a naïve conception of knowledge might say: "*Laws of physics are obeyed or they are not: therefore, there is a correct kayak roll technique which you want your athlete to master*". Holding such a belief may be conducive to the coach being certain that this 'technical template' is appropriate in all situations and with all learners. As the knowledge of this technique requires understanding of the fundamental principles of mechanics applied to the interaction of body, boat and blade, this knowledge is held by a learned authority (the coach), and may be transmitted to the learner. Such beliefs are likely to be operationalised through transmissive coaching behaviours, involving high levels of instruction, demonstration and augmented feedback, which promote explicit learning (Grecic & Collins, 2013).

In contrast, a coach who believes that knowledge is complex may report: "*All individuals are different and biological systems are by their very nature fuzzy and evolving. Consequently, while we can identify some absolute rules (e.g., 'you have the potential to roll a kayak more easily if the posture of the core and head and the position of the paddle offer a biomechanical advantage'), there is considerable nuance when working out what is best for each individual in each situation and at each time point in their development, and it is a case of working it out rather than applying a template*". Similarly with certainty of knowledge the coach may feel that: "*I am confident I can get my method to work with that person, but it will probably take some adaption and time*". In this scenario, the coach is more likely to believe that to acquire a functional roll the learner would, to a lesser or greater extent, be involved in the construction of such knowledge. For this process to occur, the coach must organise an experience where the learner recognises that their present solution is inadequate. ~~Thus, t~~The coach is then more likely to utilise a~~n~~ learner-centred, constructivist approach that emphasises using divergent, problem solving questions such as: "How could you achieve a functional rolling position if you capsize in X, Y or Z posture?", and allowing the

learner to experiment with the solutions that they suggest. Such methods are likely to promote self-analysis, reflection and decision-making in both the learner and coach; behaviours that are closely aligned to a coach operating sophisticated epistemic beliefs (Grecic & Collins, 2013).

The examples above illustrate how the coaches' distinctive behaviours arise as a consequence of their (consciously and unconsciously held) conceptions of what knowledge is, and how it is acquired; that is, as a result of their personal epistemology. Although the connection between underpinning beliefs and behaviours may be subconscious (Lyle & Cushion, 2017), an explicit connection may be made through the adoption of a coaching philosophy. A coaching philosophy is a set of statements that specify the means by which a coach's underpinning beliefs will be enacted as behaviours (Gilbert, 2017). Grecic and colleagues have termed the alignment between values and beliefs, philosophy and coaching behaviour as the 'epistemological chain' (Collins, Collins & Grecic, 2014; Grecic & Collins, 2012; Grecic & Collins, 2013; Grecic, MacNamara & Collins, 2013). Consequently, the goal of enhancing coach behaviour may be best achieved through understanding, evaluating, and developing a sophisticated epistemological chain.

The influence of the adventure sports coaching environment on coaches' conceptions of knowledge

We suggest that there are two ways in which the adventure environment may influence ASCs' personal epistemology. Firstly, the different social structure, and more dynamic physical and temporal aspects inherent in the adventure sport context; and secondly because of the importance given to independence as an objective in adventure sport coaching (Christian et al., 2017). We are not suggesting that traditional sporting contexts are devoid of these two characteristics. Rather, we suggest that that both the dynamic context and the need for independence are accentuated in the adventure environment.

With regard to the dynamic nature of the adventure environment, while we accept that no two badminton games or football matches are the same, the location and physical structure of the spaces are. In contrast, the back country ski coach will have to consider a multitude of environmental variables (snow pack, anticipated weather conditions, actual conditions and the impact of these on slope conditions and snow pack stability) before she can make a decision about which area to use for her coaching. Given these factors, a ski area that was favourable for a session with a developing skier on Monday might not be favourable on Tuesday causing the coach to re-evaluate where, on a mountain with an abundance of inherent environmental intricacies, might make a suitable venue to continue from Monday's session. Thus the coach must ask: *"Is that environment suitable today and if not, where could I go today that will best lend itself to the needs of the learner?"* We propose that such an inner dialogue promotes constant comparison, questioning,

prioritisation, and a general increased demand on the planning aspect of coaching for the ASC. Furthermore, we argue that this inner dialogue promotes a mind-set that views knowledge of the adventure environment as complex, uncertain and personally-constructed through experience. In this regard the nature of the adventure sports environment is conducive to the development of sophisticated epistemological beliefs.

The second way that the environment might impact coaches' epistemology regards coaching for independence. Christian et al. (2017) concluded that this is one of the main priorities of high-level ASCs so that learners are able to make decisions for themselves when the coach is not present, or when the learner is not close enough for the coach to intervene. The need for participants to have the forethought to be able to avoid hazards in dynamic environments is of particular significance here. Examples of this might include a whitewater kayaking coach who needs to position themselves at the bottom of a long rapid for safety reasons and therefore cannot communicate with the learner for the duration that they descend the rapid, or a climbing coach preparing a learner to go independently to a crag and lead climb with peers. In both of these examples, the skill of the coach is to enable the learner to cope with unexpected circumstances in the absence of immediate support. This might be on a short term basis, as in the example of the whitewater kayaking coach example or on a longer term basis, as with the example of the climbing coach. Either way the coach must employ methods that promote self-reliance (Christian & Kearney, 2015). Such a 'problem solving' approach is associated with coaching behaviours such as: increased use of divergent questions, variable practice, decision making tasks and the development of intrinsic feedback which, as outlined by Grecic and Collins (2013), are coaching behaviours associated with sophisticated epistemological beliefs. We propose that the environment within which adventure sports occur directly impacts the proximity of coach-to-learner (in both the short and long term) and that acts as a pivotal factor in the decisions that the coach makes when selecting appropriate methods of delivery.

We are not suggesting that traditional sport coaching contexts are static, or that they do not emphasise the need for independence. Rather, the environments in which adventure sports are coached are *more* dynamic, and have *more* urgency for independent performance. In effect, the ASC is constrained to achieve early learner independence because it is a pre-requisite for successful navigation through the physical environment. The ASC is forced to evaluate and adapt on a more frequent basis because of the uncertainty inherent when working within a dynamic and changable~~e characterise the~~ physical environment. Consequently, the challenges inherent in the adventure environment promote methods of coaching that are associated with a sophisticated epistemology.

The influence of the adventure sports coaching environment on coaches' pedagogy

This section further develops our position that the accentuated features of the adventure environment may serve to promote the development of sophisticated epistemic beliefs with reference to pedagogical theory and practice. To date, little attention has been directed to this aspect despite some common assumptions about coaching practices used in the field. Collins and Collins (2016) come close when they identify the "highly dynamic and literally relentless environment" (p. 1232) often experienced by ASCs as instrumental in developing a refined capacity to engage with information sources and make appropriate decisions, often referred to as professional judgement and decision making (PJDM). Collins and Collins also specifically identify a pedagogic component to PJDM and this section will therefore offer some critical pedagogical arguments to support this emerging phenomena amongst high level ASCs.

Mosston and Ashworth (2002) provide a well-established framework for pedagogic practice in their Spectrum of Teaching Styles. The benefits of applying this model to the ASC context is that it expounds the decision making that underpins the strategy selected by the coach. It is decision making that this section seeks to explain in light of the physical and social adventure sports environment but we must first briefly outline the key characteristics of the Spectrum. At one end (command style), the coach will make all the decisions regarding content and delivery whilst at the opposite end (self-teach) these decisions are assumed by the learner. Each of the eleven styles along the spectrum represents a shift in responsibility and decision making for coach and learner but it is essential to appreciate Mosston and Ashworth's (2002) assertion that each style on the spectrum is of equal value. Moreover, each style is selected in relation to the type of learning outcome desired. Mosston and Ashworth (2002) refer to this as the 'non-versus' approach and contest that learner centred approaches are not inherently more valuable but depend upon overall aims, context and motivations.

INSERT FIGURE 2 HERE

Figure 2. The Interrelationship between Teaching Styles and the Epistemological Chain (Adapted from Mosston & Ashworth, 2002 and Grecic & Collins, 2013).

Mosston and Ashworth's (2002) work has particular relevance here when we see similarities between the Teaching Styles Spectrum styles and the Epistemological Chain (see figure 2). On the left of Figure 2, we see pedagogy influenced by reproductive teaching styles dominated by high levels of practice and conformity. When used *exclusively* we would argue that these practises are commensurate with more naïve epistemic beliefs. At the opposite end however, we see pedagogy influenced by problem solving, independence, and hypothesis testing leading to productive outcomes which are associated with sophisticated epistemic beliefs. Whilst it is beyond the scope of this paper to examine all eleven teaching styles, there are some striking examples that illustrate how an ASC would be forced to reflect upon the efficacy of particular styles. We must assert however that if an ASC is only capable of utilising coach-centred approaches such as command and practise styles in a dynamic environment, then their role is more of a guide than coach (Collins & Collins, 2012). This restricted approach is in contrast to the ASC who occasionally chooses to use these coach-centred approaches based on the needs of the learner and the demands of the specific context.

While a high-level ASC is likely to employ styles from across the full spectrum, we propose that the nature of the surrounding physical environment, as well as the physically and temporally nested sequence of tasks required of the ASC, discourages the use of coach-centred approaches. For example, even moderately dynamic environments such as a narrow piste or single track mountain bike trail, place a high demand on the learner's attention during and in preparation for performance attempts, impeding attempts to impose a command or practice style. In addition, because each eddyline or mogul is unique, successful adaptation by the performer demands not a singular 'correct' response, but multiple responses gleaned from episodes of hypothesis testing (Gentile, 1972, 2000). Although an accurate demonstration may be desirable in the interest of short-term teaching efficiency (Morgan, Kingston & Sproule, 2005), the immediate physical surroundings available to the ASC may not offer sufficient space for all participants to safely and effectively observe. Furthermore, in a gravity sports context, a demonstration will move the coach away from a position of good visibility of the group and usefulness. Alternatively, a failed attempt by the learner (e.g., missing an eddy or capsizing) ends the same way. So even if the ASC believed they held the simple and certain knowledge as to how a learner should best resolve each situation, this knowledge is of limited use as the situation in which such knowledge can be effectively and directly imparted rarely arises. Consequently, we propose that the ASC is likely to foster ways to encourage learners to seek intrinsic feedback or feedback from each other (reciprocal style) in the absence of the coach. That is, the adventure environment promotes the use of productive styles within the spectrum.

The socio-cultural nuances of the adventure environment are also proposed to strongly influence the pedagogical strategies employed by the ASC. Many adventure sports are characterised by the absence of arbitrary rules; for example, freedom of route selection in mountain biking or skiing. This high level of choice facilitates participants differentiating tasks based on their psychological state and technical ability. Furthermore, ASCs are often required to work with a wider variety of abilities within the same episode (Berry, Lomax & Hodgson, 2015). These socio-cultural constraints promote what Mosston and Ashworth (2002) describe as inclusion styles. We propose that these constraints could facilitate more sophisticated conceptions of knowledge, especially in relation to the concepts that learning is personally constructed and occurs at different speeds depending on the learner.

Indeed, once the coach has accepted less direct control and more flexible 'terms of engagement' such as those exemplified by inclusion style, the coach may then seek to exploit more situations that facilitate experimentation. Mosston and Ashworth (2002) identify this approach as guided discovery. Whilst they would contest that at this stage the coach's goal would still be 'correct' outcomes, guided discovery represents a further shift in thinking where the coach "invites the learner to go beyond facts and memory" (Mosston & Ashworth, 2002, p. 11). The coach utilising this approach first sets a task; through reflection on actions, the learner then responds physically to a series of questions that guides them to a desired outcome. Through testing various hypotheses, the learner is guided to an answer that suits their specific situation. The coach can no longer 'own the learning', for the dynamic nature of the environment demands unique responses to it. For example, the amount of edge required on a ski for turning will be unique to the length of ski, speed of skier, mass of skier, and variability of terrain throughout the run and throughout the day. Mosston and Ashworth refer to this point in learning as the Discovery Threshold and it represents a transition from reproductive styles of learning to productive styles. Epistemologically, it also represents a shift in thinking more towards responses from the coach that start with 'it depends'. Such a conception of knowledge being complex, tentative, personally constructed and developing slowly over time is sympathetic with Schommer's (1990) conception of sophisticated epistemic beliefs.

An ASC who then accepts greater degrees of variability in problem solving in light of environmental demands would now see the environment as providing greater opportunity. In this way, greater variety in learner process is actually desirable in the productive cluster of styles beginning with the divergent style. The environment presents potentially limitless options of descending rapids, mountain bike trails or ski runs. The more experienced the coach, often the greater variability and demand the environment poses and so Mosston and Ashworth argue that this 'landmark style' now encourages variety, creativity and "emphasises cognitive adeptness" (p. 248). Thus the coach-athlete

relationship becomes more of mentor than guru. Trust is developed, as are opportunities for independence, creativity and autonomy.

Adventure sports coaches' engagement with learners can be sporadic or even singular and so ASCs report the need to develop the ability to perform and learn independent of the coach (Christian et al., 2017; Collins & Collins, 2012). According to Mosston and Ashworth (2002), this drive to independence would fall into the Self-Teach style and is notable in that the learner moves beyond the need of the coach being present. In a traditional sport's context this may seem unusual, but we believe further supports the phenomena where the physical and social environment play a part in facilitating more sophisticated epistemic beliefs in high level ASCs.

To summarise, we conceive that an ASC's learning journey is not necessarily linear as described but does involve progression through the spectrum from coach centred to learner centred. In analogous terms, we may perceive of each teaching style as a locked box that can only be accessed with developing epistemic beliefs. For example, if an ASC conceives of knowledge as fixed, certain and handed down by authority, it would preclude them from teaching styles where the learner's construction of their own knowledge is fundamental. In this way, the development of epistemic beliefs and the ability to utilise a range of teaching styles are intertwined. In the ASC context, due to the nature of a dynamic physical and socio-cultural environment which encourages analysis, comparison and critical thinking, we hold that high level ASC's contend with uncertain outcomes which ultimately facilitates more sophisticated epistemic beliefs.

The impact of environment-led decision making on the development of epistemic beliefs: an ecological dynamics perspective.

This section explores the impact of the volume and weight of high-impact decisions that an ASC is required to make during coaching. We believe the decision making load and necessary reflection on dynamic decisions contributes to the epistemological development of the ASC. We will refer to two core aspects of theory: the theory of Attunement to Environmental Affordances (Gibson, 1966; 1979) and Theory of Mind (Baron-Cohen, 1991; Premack & Woodruff, 1978).

Attunement to environmental affordances

Gibson (1979) saw perception and action as directly coupled where the perceptual system is constantly acquiring information about opportunities for action. These opportunities are known as affordances (Rahman, 2012). 'Seeing' an affordance is a transactional process; affordances emerge as a function of the state of the environment and capabilities of the observer (Fajen, Riley & Turvey,

2008; Orth, Davids, Chow, Brymer & Seifert, 2018). It is a solution focused and creative process as affordances are ultimately aim driven. A classic and widely used example is that a chair provides the affordance to sit down. It doesn't force one to sit down but it provides that opportunity. The chair is 'seen' as a 'sitable-onable' object. In fact any stable platform between knee and hip height may be seen as a 'sitable-onable' object. This 'sitable-onable' capability will only be exploited if the observer considers this affordance to be the most attractive possibility in their environment. We actually avoid sitting on most of the 'sitable-onable' objects we encounter in our everyday lives, even when we want to sit down. We pick a specific affordance because it best conforms to our requirements: comfort, viewpoint, convenience, or a combination of factors. The chair can also offer different affordances, depending upon the sociocultural environment or the observer's goals. Thus a chair can be a step to reach a high shelf, or in a cowboy movie it might even be a weapon!

The adventure environment offers a multitude of affordances and most of them are quite subtle (Orth et al., 2018; Seifert, Orth, Mantel, Boulanger, Hérault & Dicks, 2018). For example, on a difficult rock climb the differentiation between a blank piece of rock and a potential foot hold is elusive. It can be problematic for the learner to recognise the affordances and choose between them. The theory of affordances is applicable beyond physical structures. Affordances also explain key parts of human social interactions (Fajen et al., 2008). We need to be able to 'read' social situations and estimate other people's motivations and likely behaviour. Other people afford us opportunities to interact and behave in certain ways. An attentive belayer will enable the climber to take a bigger risk when using a marginal foothold. Thus coaches need to facilitate the development of interpersonal communication and trust.

It is often assumed that we learn through the storage (in memory) of a pre-determined action plan (Schmidt, 1975), however, ecological theorists view solutions as emerging from a 'self-organising' process (Davids, Button & Bennett, 2008). The learner constructs a solution based on factors known as constraints (Brymer & Davids, 2014). Newell (1986) organised constraints into three categories: individual, task and environment. Individual constraints are both structural and functional; height would be a structural constraint, while functional constraints include aspects such as cognitive variables and strength. Task constraints include rules, goals and equipment. Environmental constraints include both physical and sociocultural elements. The learner will refine their solution until it is efficient, drawn towards an 'attractor state'. The attractor state is a stable pattern and once established that solution becomes dominant; the learner will solve the problem (self-organise)

in a consistent way (Kugler, Kelso, & Turvey, 1982). If the constraints of the situation change, then the attractor state is disrupted and the learner seeks a new solution. When the ASC wants the learner to produce a different response then the constraints need to be arranged in a way that disrupts any existing attractor states and encourages the natural formation of a new pattern. This is a serious challenge for the coach. At first changes may be a little hit and miss but a new functional solution should gradually become more efficient and ultimately more stable as the learner becomes attuned to the affordances offered under the new set of constraints. In time the original attractor state may disappear completely or only reappear in very unusual circumstances. For example, in skiing the coach will eventually want the learner to abandon the snow plough turn. This means losing the reliance on a stance between opposing ski edges (snow plough) and adopting a stance on two matched edges (parallel turn). The skill in coaching is to organise constraints that challenge the learner in a way that makes the snow plough stance 'uncomfortable' enough to encourage reorganisation.

Manipulating task constraints, like imposing rules on an activity, can be effective but a key constraint the coach will always be working with is the physical environment. We have already explored the degree to which the complex and dynamic nature of the adventure environment is central to the ASC's challenge. This complexity means that learners in the adventure environment are exposed to a multitude of competing affordances. Think of the number of affordances offered by a long white water rapid. There will be many good solutions to paddling the rapid but each decision as the paddler progresses downstream will change the remaining affordances and their desirability. Compare this to an athletics coach; on the track there are relatively few, relatively simple environmental affordances which are standardised between venues. In hockey practice, there will be more affordances than in the track example but still far fewer than on the white water river. Thus, we propose that environments lie on a continuum in terms of the number and complexity of the affordances that they present. The increase in affordances produces a corresponding increase in the decisions that the ASC is required to make to optimise the activity, or even keep it on track.

The time taken to complete an activity, such as a football game, is fixed. Even the 'worst' football match stops after 90 minutes. However, on a bad day on the river the ASC may find themselves in a position where to end the activity in a condition they approve of requires a substantial effort and perhaps hours of 'extra time'. The ASC is constantly challenged to evaluate how each decision they make could impact on completing the session in a safe and timely manner. We contend the emotional loading of decisions like this for the ASC provides a 'weight' that promotes introspection. The volume and 'weight' of decision making inherent in adventure sports becomes a key driver on

the introspective process and in turn promotes the development of sophisticated epistemic beliefs as knowledge is seen as complex, tentative and uncertain.

An effective coach needs to understand the challenge of the activity from their learner's viewpoint (Gilbert, 2017). The theory of affordances presents us with a problem because affordances are bound to the individual 'organism' (Fajen et al., 2008; Orth et al., 2018). No coach can ever experience the affordances perceived by their learner because they will inherently have different performance capabilities. However, a good coach will try and bridge this perceptual gap by cognitively 'mapping' the learner's capability onto the environment. We imagine, to the best of our ability, what the other person is thinking; generally we refer to this style of cognitive process as Theory of Mind (Barron-Cohen, 1991). Theory of mind is distinct from empathy or emotional intelligence in that we are attempting to exactly replicate the thought patterns of another, rather than more generalised emotional states (anxious, excited etc.). The challenge for the ASC is to make this perceptual-cognitive leap in an environment where their learner is bombarded by complex and numerous environmental affordances. This already complex task is further compounded as the ASC will often have to perform this task whilst engaged in the activity themselves (e.g., leading a skier through high-speed long-radius turns). Inevitably, the coach will make mistakes. We suggest these instances lead the coach to question their abilities, and promote the reflective cycle (Kolb, 2018; Rea, 2006). At this point, the learner becomes the 'expert' in that the coach must solicit corrective feedback from the learner in order to recalibrate the coach's assumptions. This 'learner-as-expert' position challenges the coach-centric knowledge base and helps the coach view knowledge as co-constructed rather than passed down by omniscient authority.

In summary, we feel that the theory of Attunement to Affordances and Theory of Mind may help to explain the epistemological development of the ASC. The role of the coach is to facilitate the learner's attunement to affordances. This is a highly complex demand given the volume and consequence of affordances in the highly dynamic and changeable adventure environment. The individualised nature of attunement to affordances means that each learner must create their own knowledge base where judgements about affordances must always be made by the learner and the coach is forced to accept learner autonomy. Although this is also true in 'traditional' sports, the greater number of affordances (in all their guises) that the coach and performer must contend with in the adventure sports context brings this autonomy to attention more frequently and distinctly.

Consequences of decisions in the adventure environment can be serious, even life threatening. Despite the shared nature of knowledge, the ASC remains ultimately responsible for the wellbeing of their learner in a potentially perilous environment and this weight is conducive to a highly

introspective and reflective mind set (Tozer, Fazey & Fazey, 2007). Even successful decisions are often reviewed and analysed (Edwards & Nicoll, 2006). We propose that this reflective, analytical cycle is conducive to the development of sophisticated epistemic beliefs about the nature, certainty and structure of knowledge.

Summary

Our position is that the coaching environment in which ASCs operate is the mediating factor which makes adventure sports coaching a 'little bit different' to traditional sports coaching. The highly dynamic physical, social and temporal environment develops a coaching mind-set that considers knowledge as complex, tentative and uncertain. Such a view of knowledge signifies sophisticated epistemic beliefs and is likely to result in learner-centred coaching behaviours that develop learner independence. From the pedagogical perspective, the dynamic adventure sport environment actively encourages the ASC to utilise productive, rather than reproductive approaches of the teaching styles spectrum. These styles are associated with the learner constructing highly individualised and contextual knowledge rather than the coach transmitting it. Coupled with this is the demand on the ASC to continually interact with affordances, which results in a volume and 'weight' of decisions about the needs of the learner as well as their own performance. This 'weight' of decisions is conducive to an introspective and reflective mind-set, which again is associated with sophisticated epistemic beliefs.

We hope this paper stimulates further debate on the distinctive nature of coaching adventure sports. We believe that examination of the adventure sports coaching sub-discipline is valuable in understanding the impact and influence of environmental features on coaches in other contexts. We encourage others to debate the contribution of the environment in developing coaches' epistemic beliefs. Finally, we hold that a coach's epistemological chain is key in their development and we call for academics and practitioners to continue to pay attention to this pivotal theme.

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